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# Alignment of TRT wrt SCT in M6 Data

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and Christian Schmitt

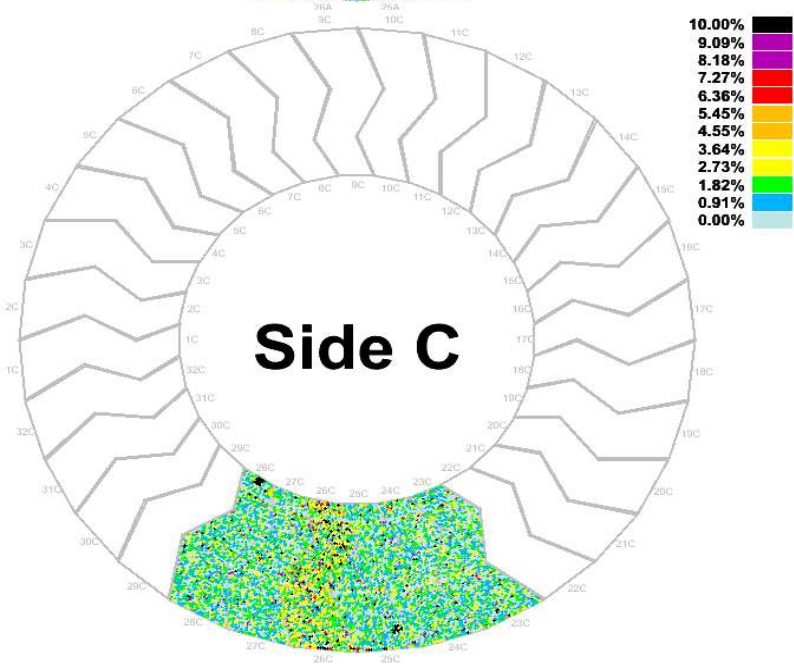
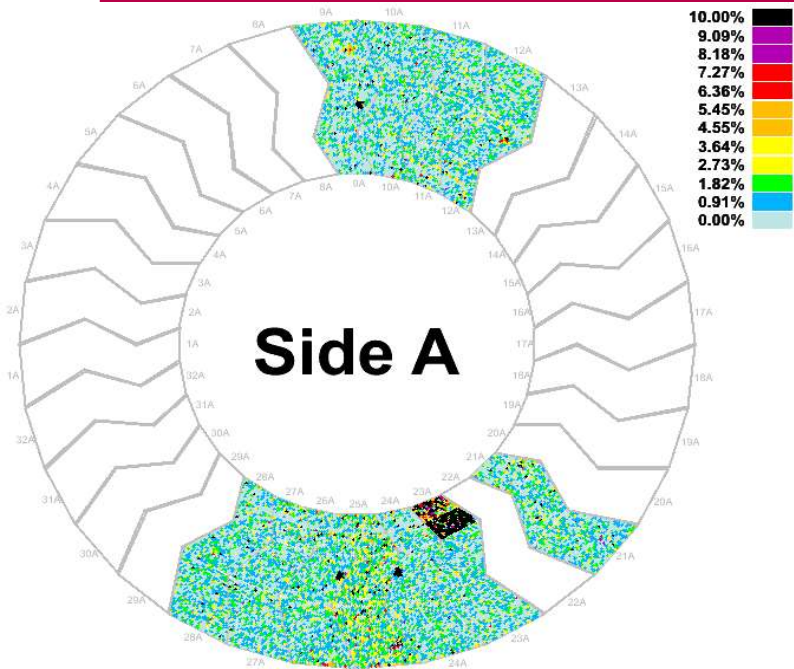


# M6 TRT Alignment

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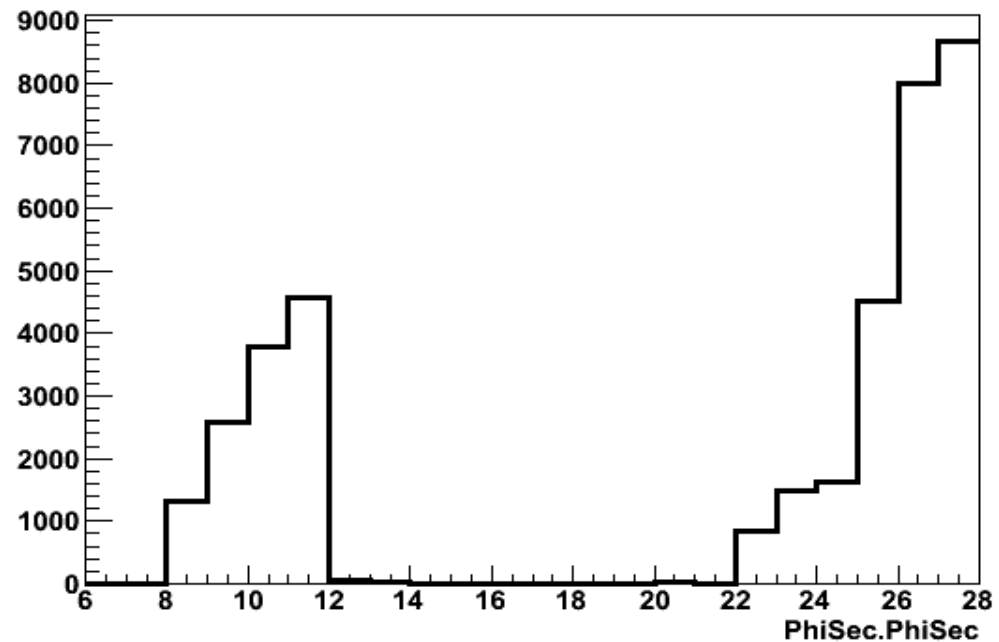
- Ran the L1 (global) TRT alignment using M6 data.
- Required tracks with:
  - > 5 SCT hits
  - > 20 TRT hits (throw away tube hits)
- Aligned 5 Dof (2 translations, 3 rotations)
- Aligned “Constrained” Dofs  $dx$ ,  $rotz$ ,  $roty$

# M6 Cosmic Run



- First combined cosmic run of SCT and TRT since SR1
- TRT modules from the top and bottom of the barrel and from sides A and C were read out in M6

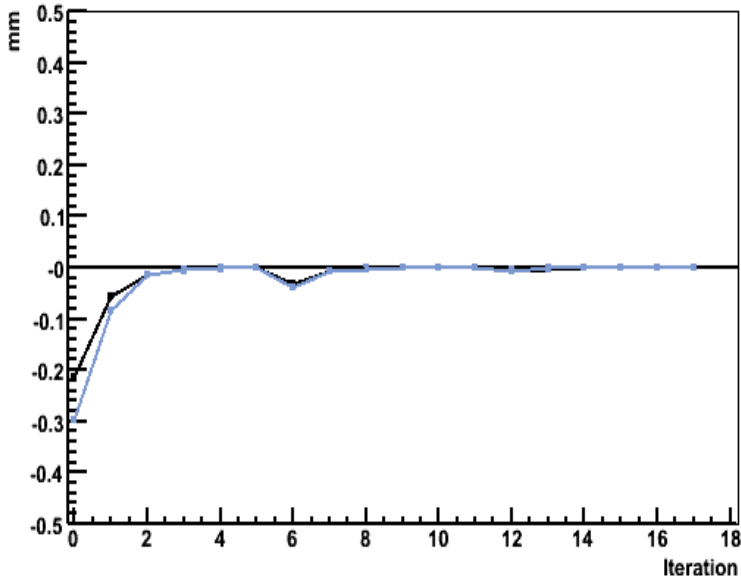
Number of Hits vs Phi Sector From Tracks Used in Alignment



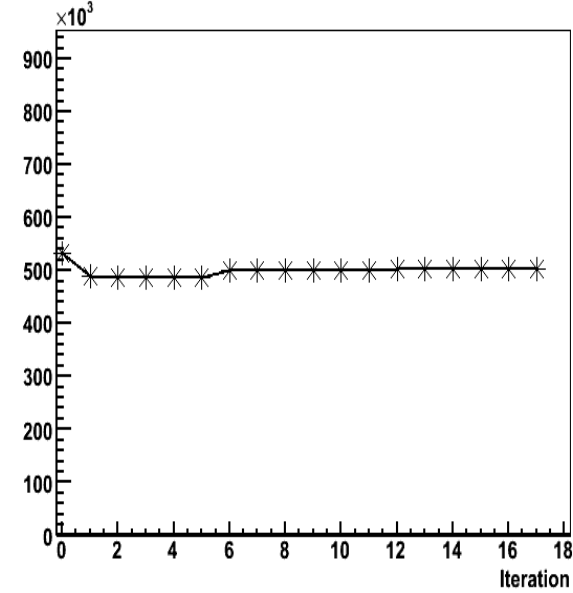


# Typical Convergences

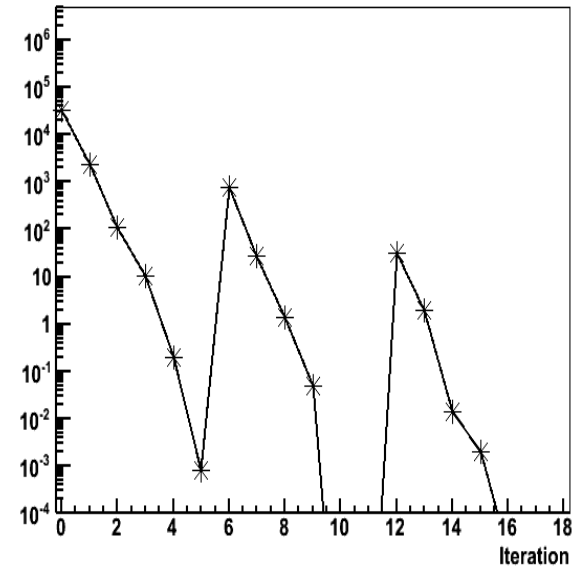
Change in X (black) and Y (Blue) vs Iteration



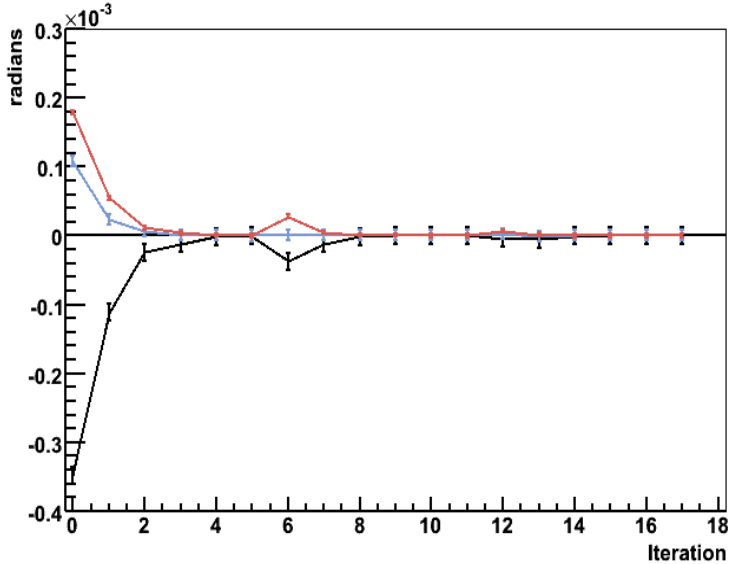
Total Chi2 vs Iteration



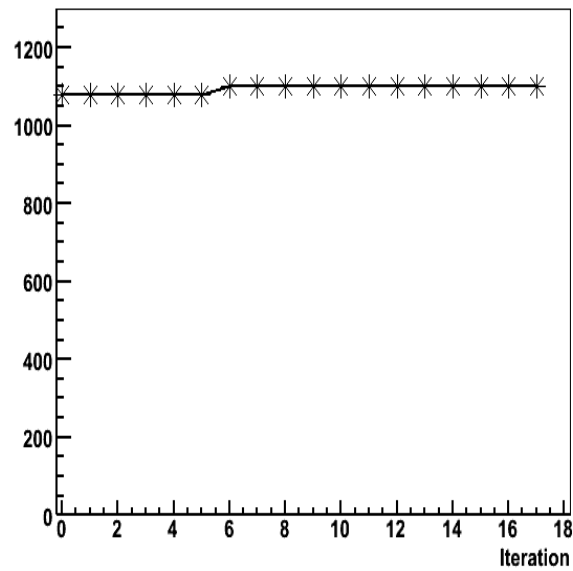
Change in Chi2 vs Iteration



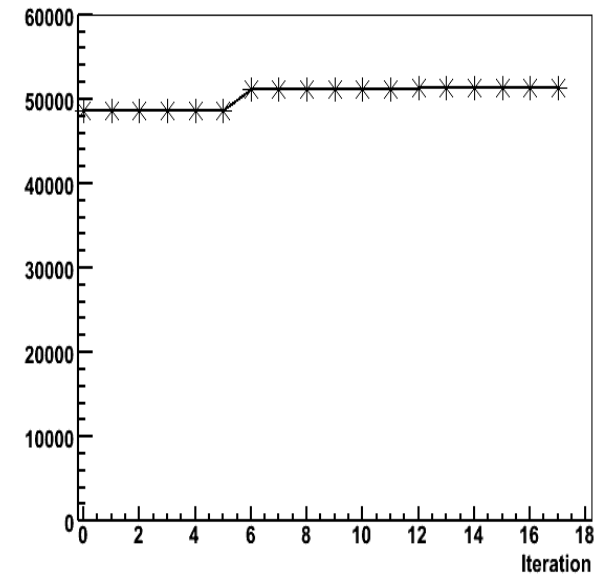
Change in rotX (Black), rotY (Blue) and rotZ (Red) vs Iteration



Tracks vs Iteration



Hits vs Iteration





# Preliminary Results

DataSet	Dof	# Tracks	Dx(mm)	Dy(mm)	RotX(mrad)	RotY(mrad)	RotZ(mrad)
1	5	1101	-0.338(3)	-0.457(4)	-0.56(1)	0.143(7)	0.290(2)
2	5	1220	-0.432(2)	-0.316(3)	-0.265(8)	0.377(5)	0.309(1)
3	5	1103	-0.406(2)	-0.365(3)	-0.388(7)	0.270(5)	0.328(2)
1	3	1095	-0.567(1)	N/A	N/A	0.449(4)	0.294(2)
2	3	1223	-0.596(1)	N/A	N/A	0.547(3)	0.313(1)
3	3	1101	-0.583(1)	N/A	N/A	0.439(4)	0.329(2)
1	3*	1097	-0.405(1)	N/A	N/A	0.420(3)	0.280(2)

\*Dy constrained to be in the position estimated from survey constraints

- Errors on the last reported digit are given by TRTAlignAlg and are expected to be underestimated by about a factor  $\sim 5$

correlation matrix:

1	-0.73272	-0.25712	-0.40854	-0.28977
-0.73272	1	0.37779	0.30638	-0.020795
-0.25712	0.37779	1	0.74015	-0.14909
-0.40854	0.30638	0.74015	1	0.17647
-0.28977	-0.020795	-0.14909	0.17647	1

## Previous Alignment Results from SR1

Dx(mm)	Roty(mrad)	Rotz(mrad)
-0.269	-0.332	-0.226



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# Validation

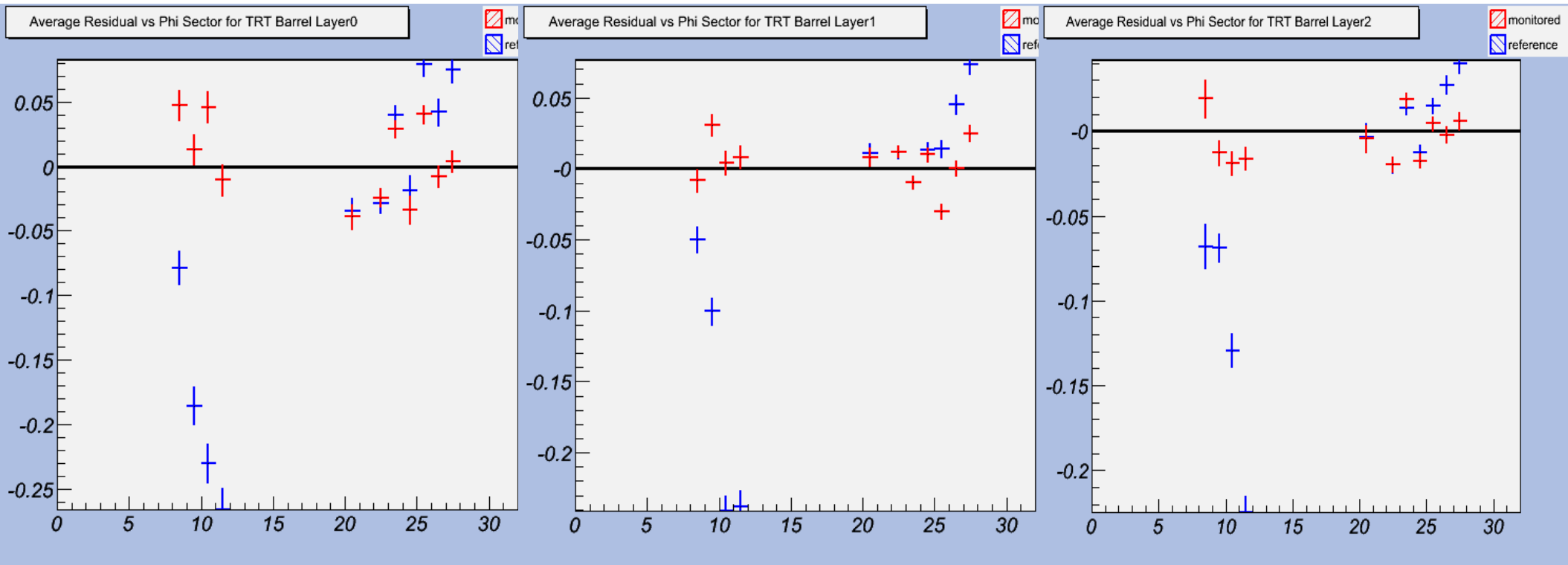
The plots shown in the following slides have been produced using the first set of alignment constants reported on the previous page



# IDAlignment Monitoring

First test of alignment monitoring package on real data.

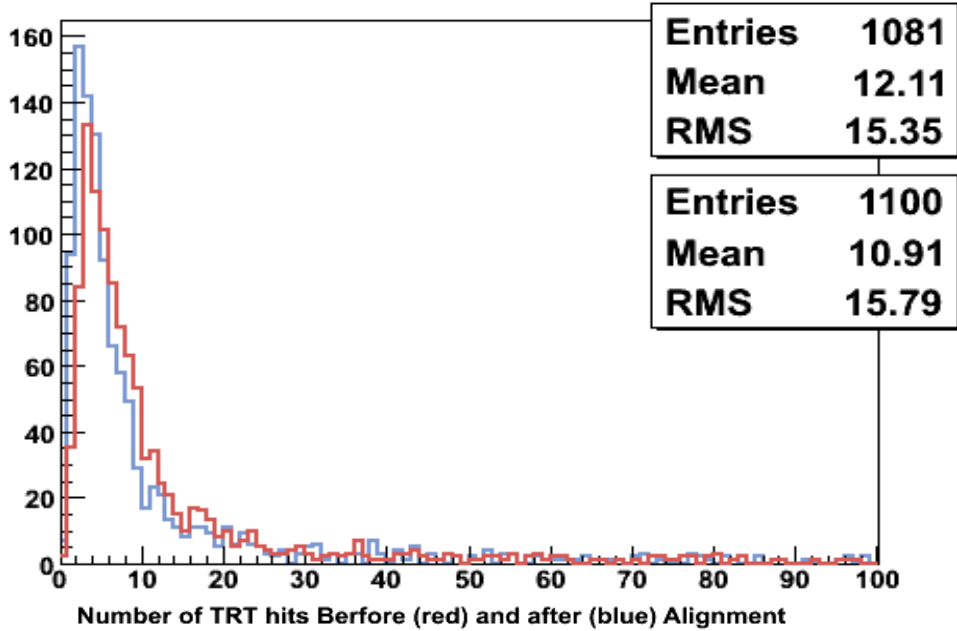
- Reference in blue is prior to alignment.
- Monitored in red is uses the updated alignment constants



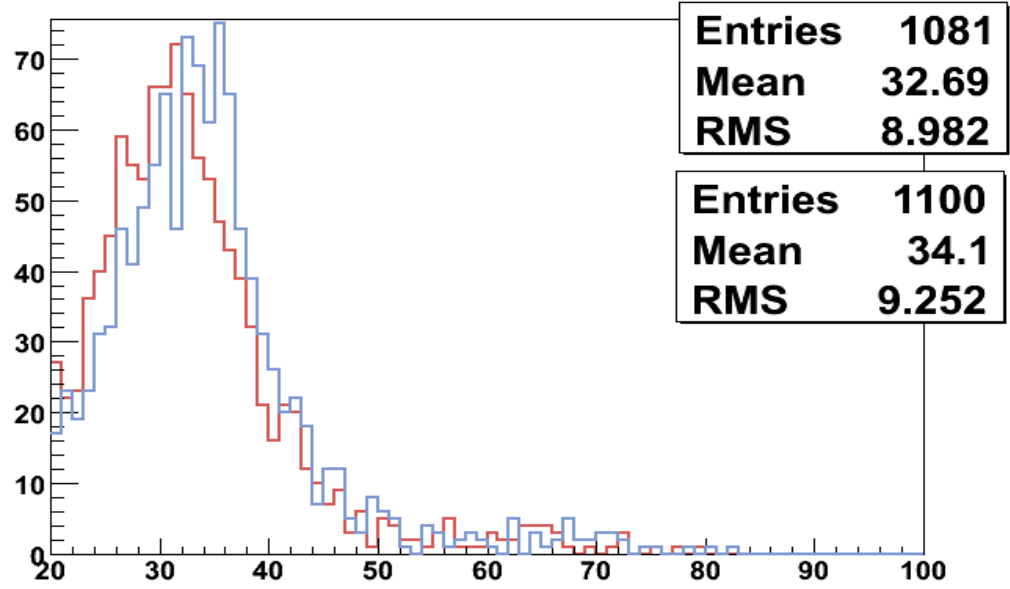
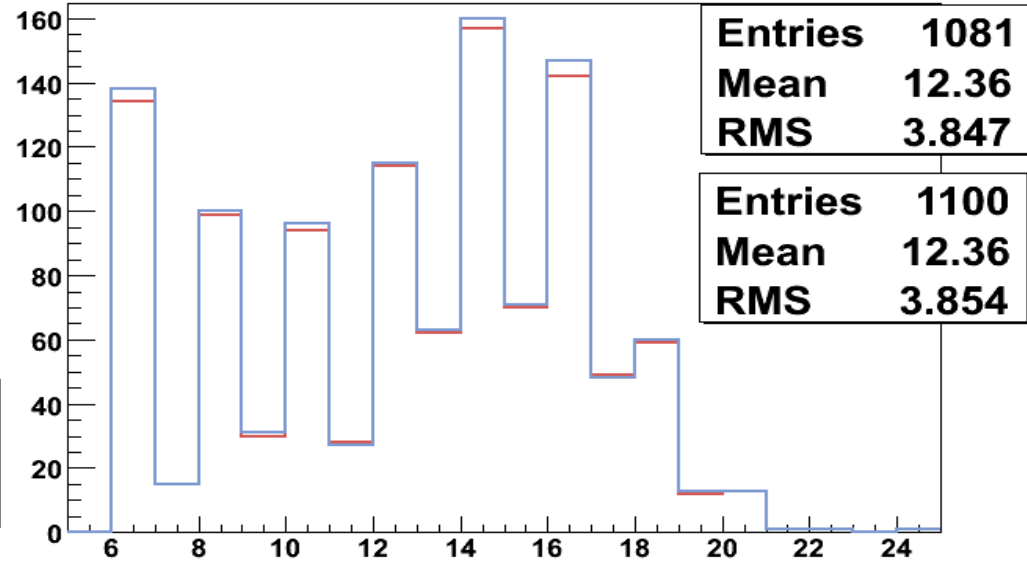


# More IDAlignMon

Track Chi2/Ndf Berfore (red) and after (blue) Alignment



Number of SCT hits Berfore (red) and after (blue) Alignment

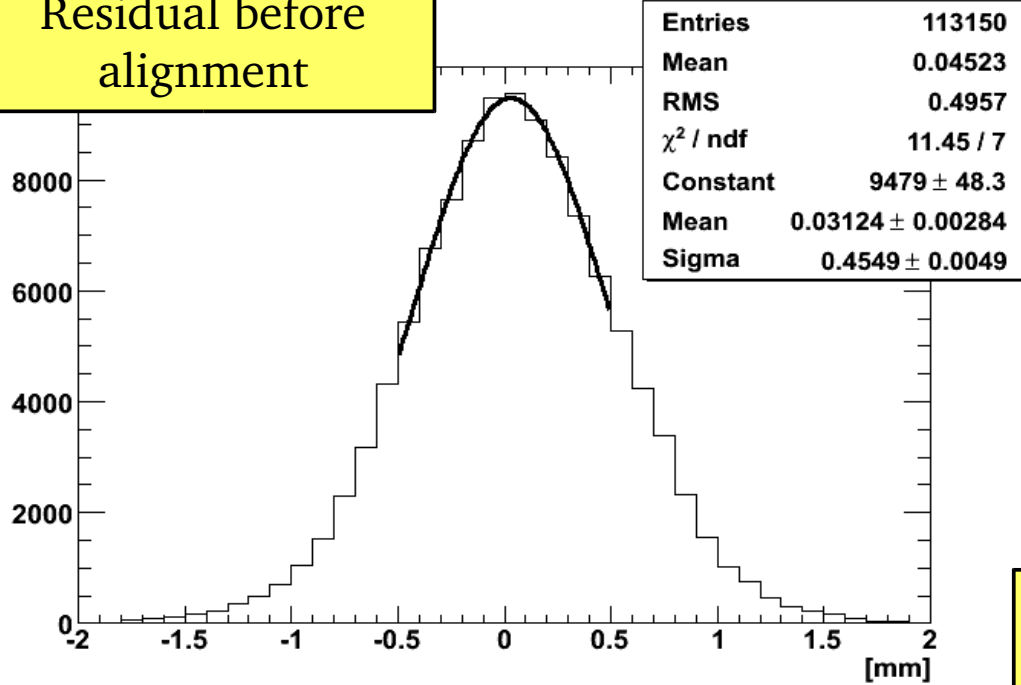






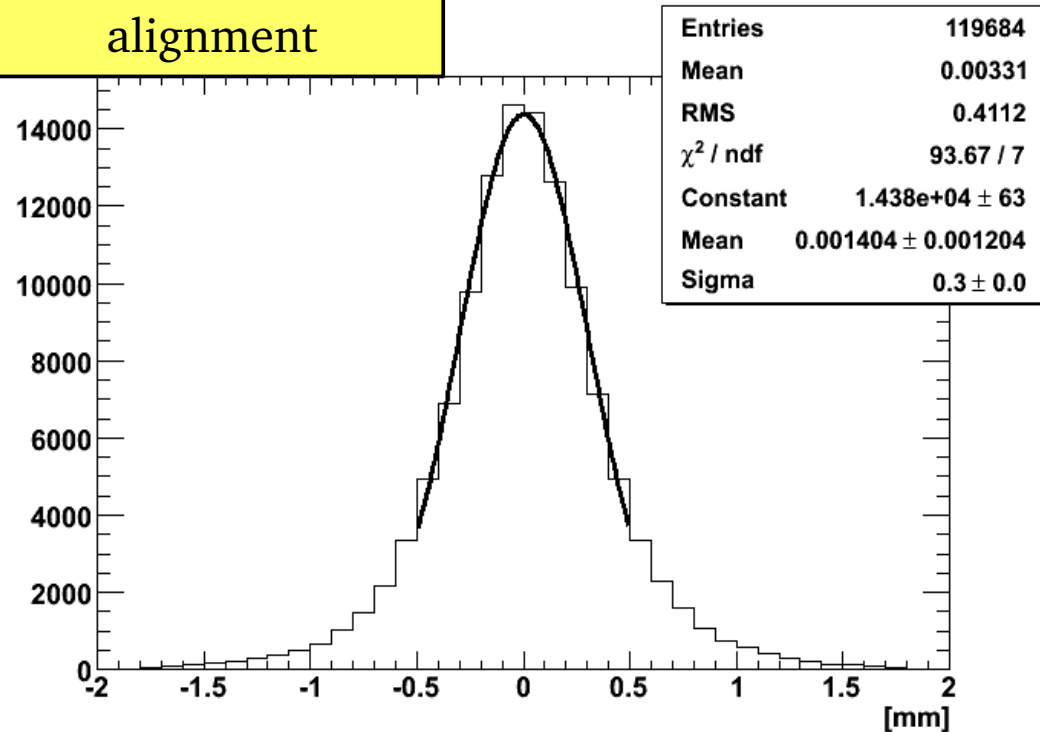
# Impact on Resolution

Residual before alignment

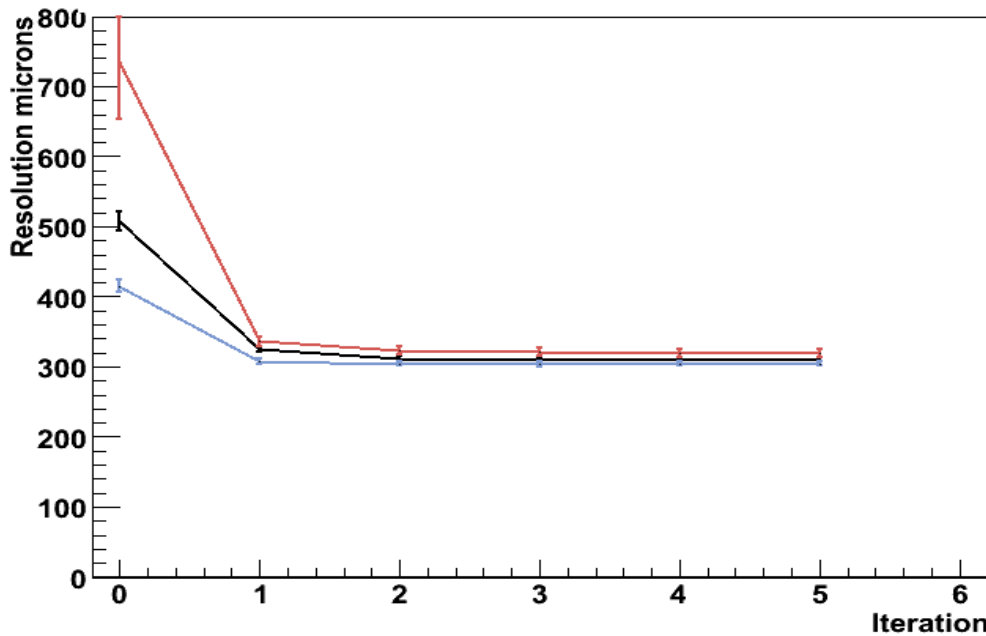


Resolution improvement:  
450 -> 300 microns

Residual after alignment



Resolution Vs Iteration for the entire TRT (Black), and upper(red) and lower(blue) modules





# To Do.

- Align L1 using tracks from Upper and Lower modules separately.
- L2 Alignment.
  - L1  $\rightarrow$  L2 Vs L2  $\rightarrow$  L1 or perhaps a mix ?
- Outliers options.
  - reject tube hits, but no cut on outliers. Optimal?
- Align using the M6 alignment constants derived for the SCT.
- Determine the errors on alignment constants in a more robust way. Calculate Chi2 as step through phase space.
- Suggestions ...?



# Reinforcements.



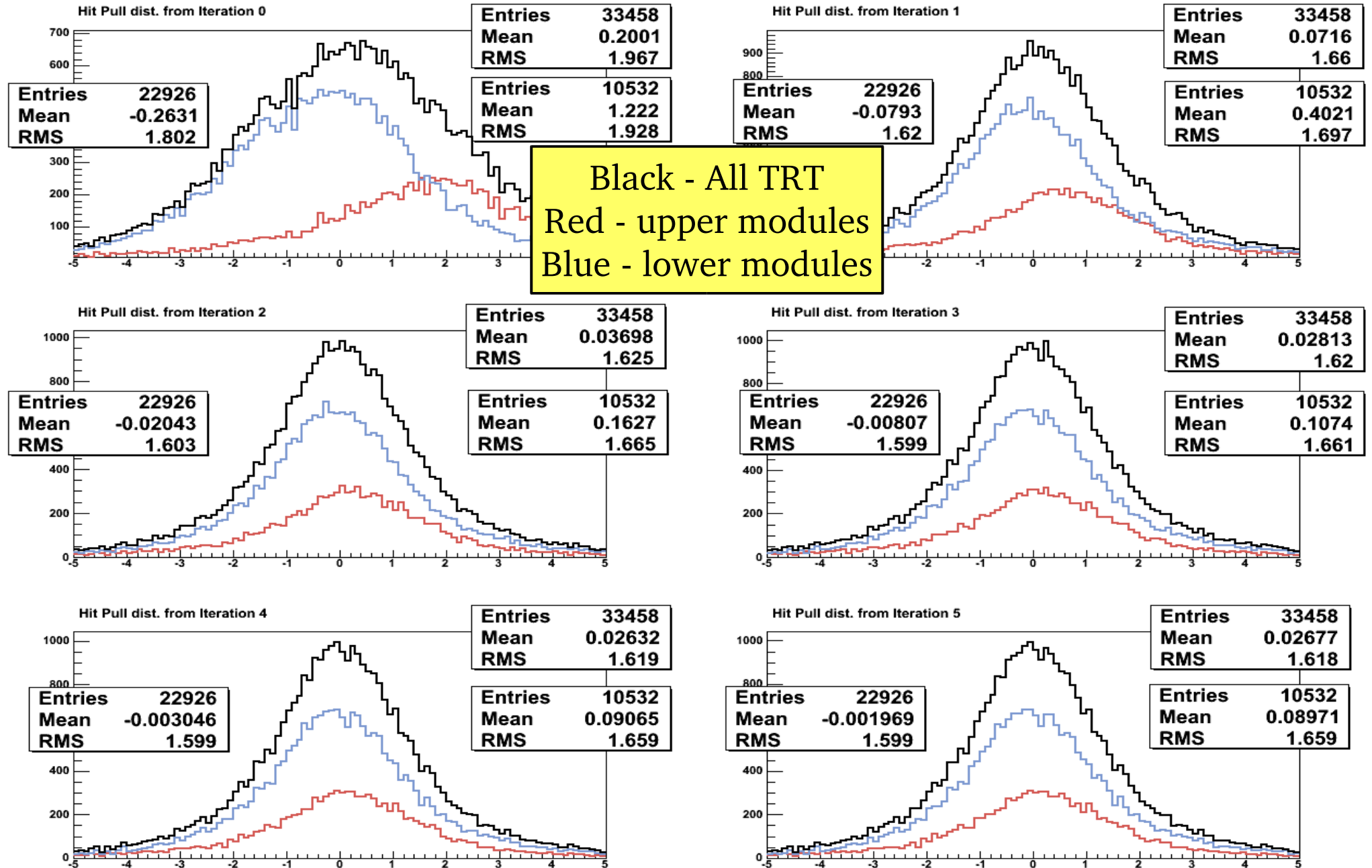
# Data Set Details

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- Data Set 1
  - run# 43719
- Data Set 2
  - run #'s 44316, 43847, 43824, 43826
- Data Set 3
  - run #'s 43829, 43860, 43864, 43868, 43872,  
43979

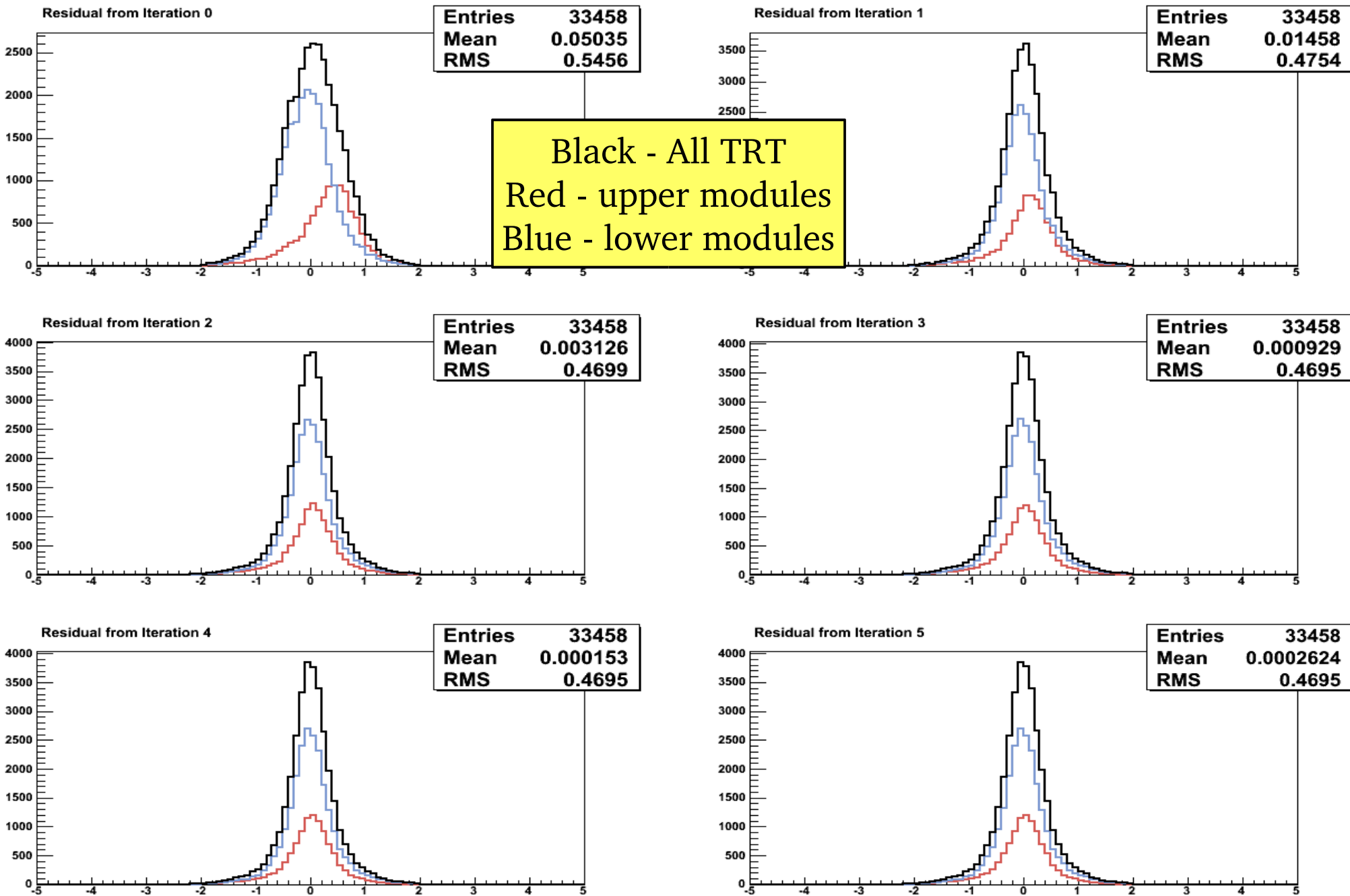


# Hit Pulls $(\text{TrkR} - \text{HitR})/\text{HitErr}$



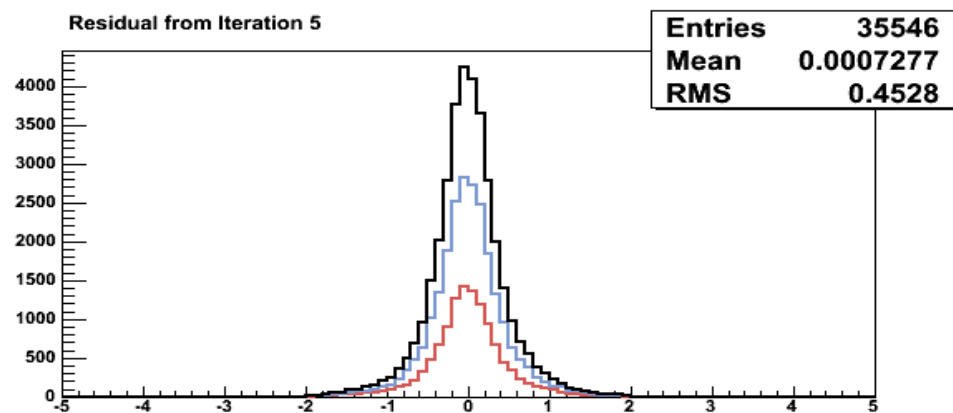
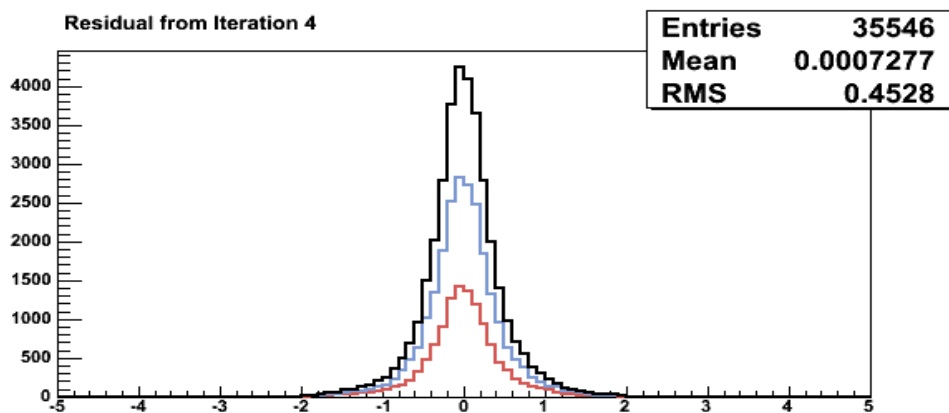
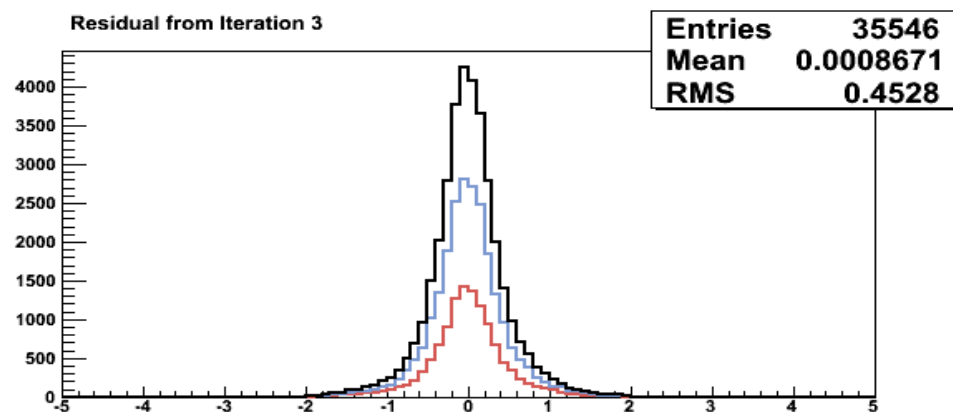
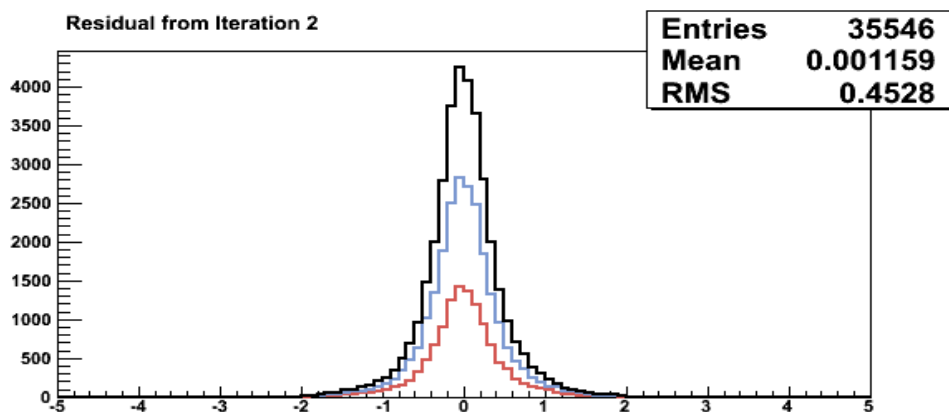
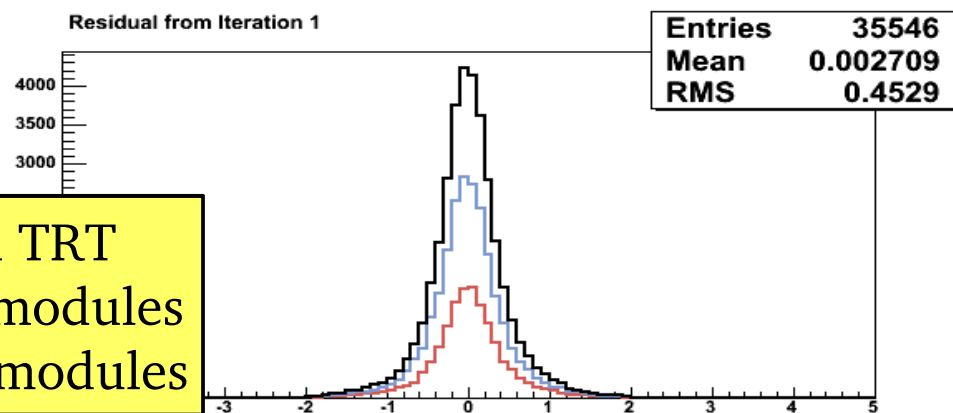
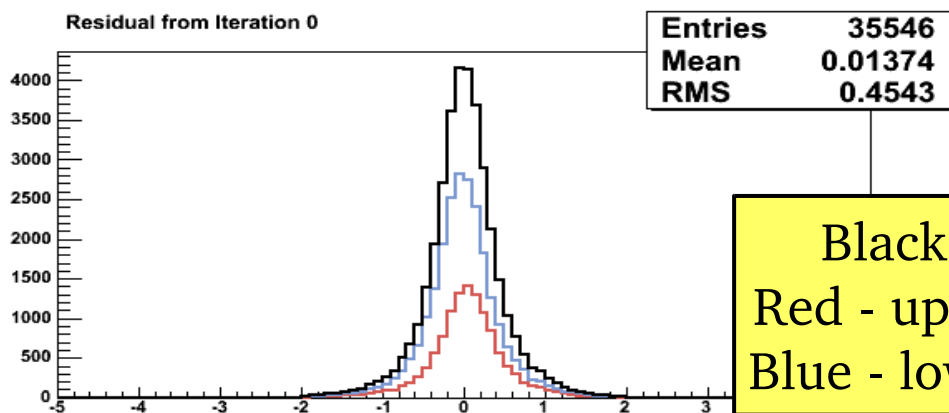


# Residuals after 1<sup>st</sup> Pattern Rec



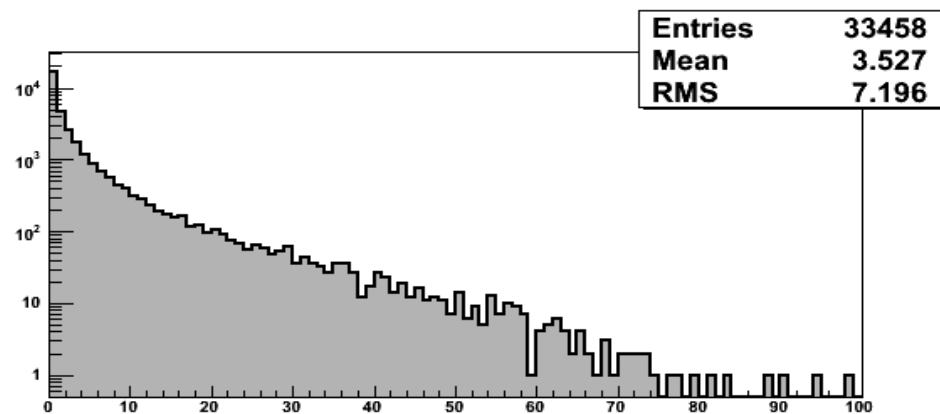
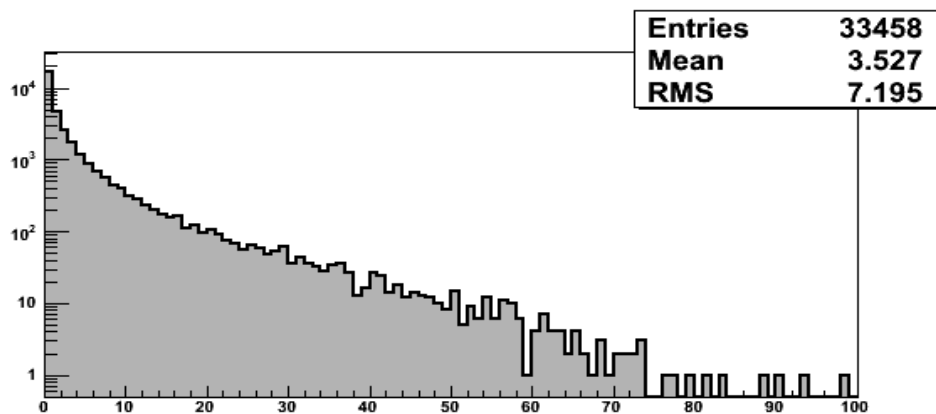
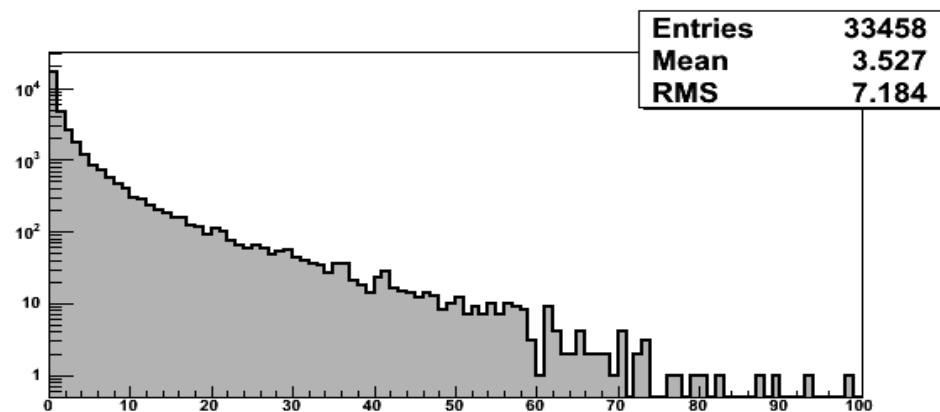
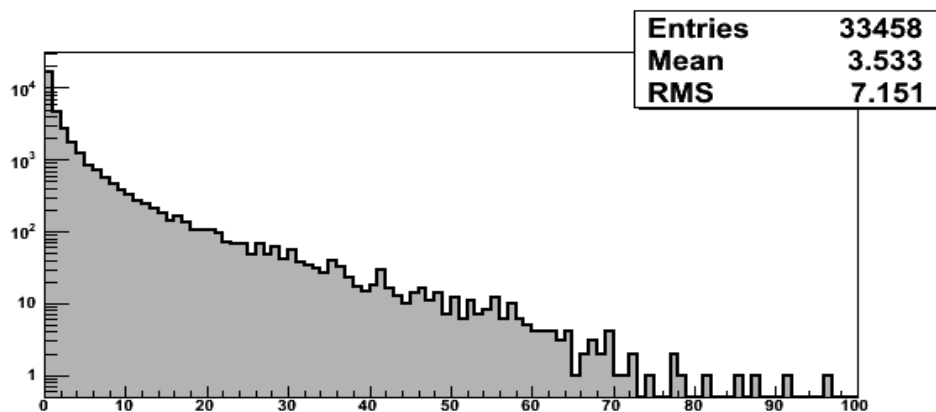
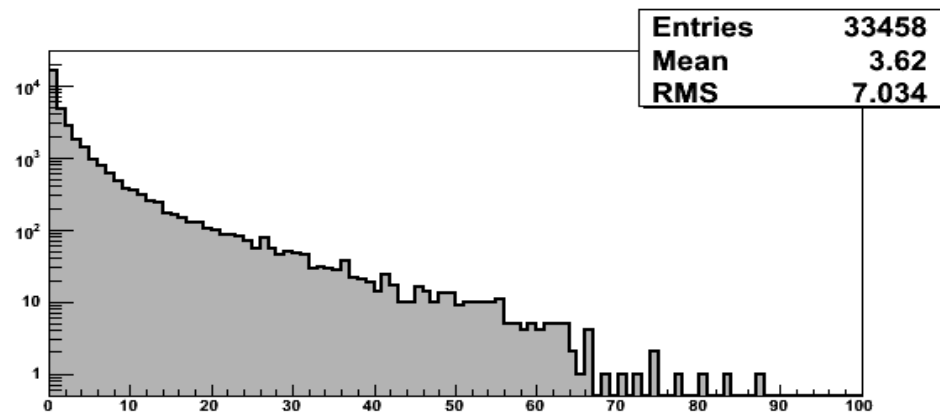
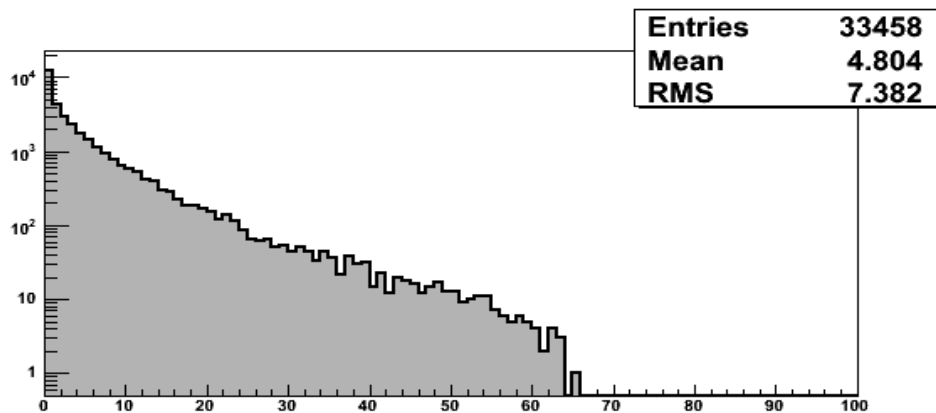


# Residuals after 2<sup>nd</sup> Pattern Rec





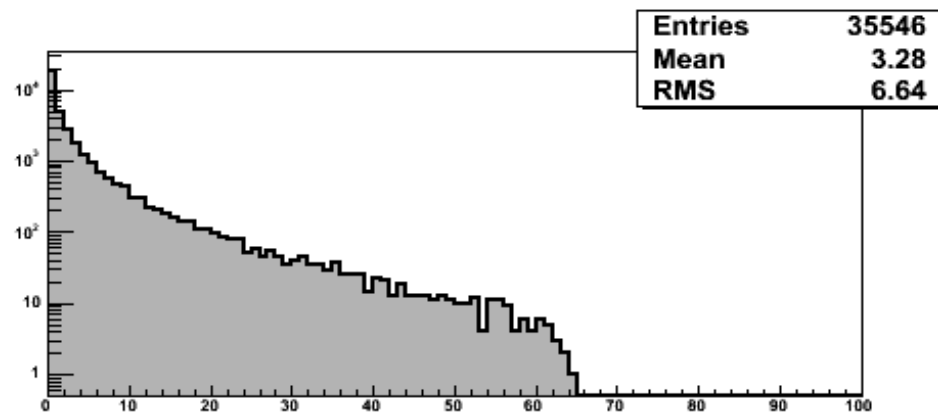
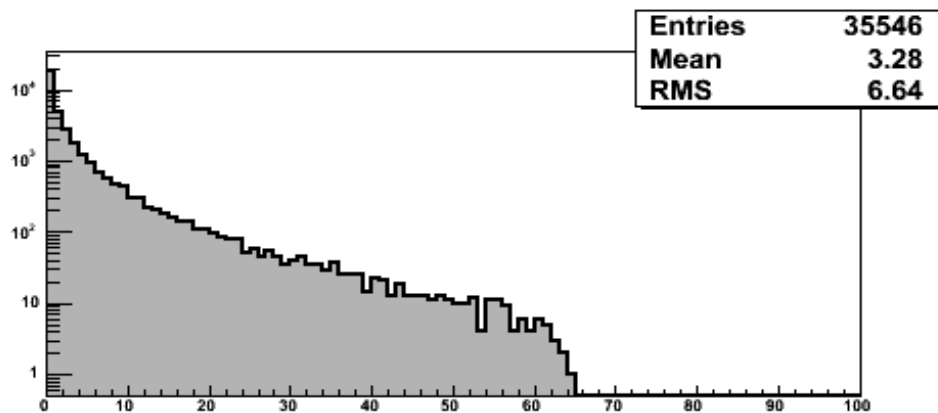
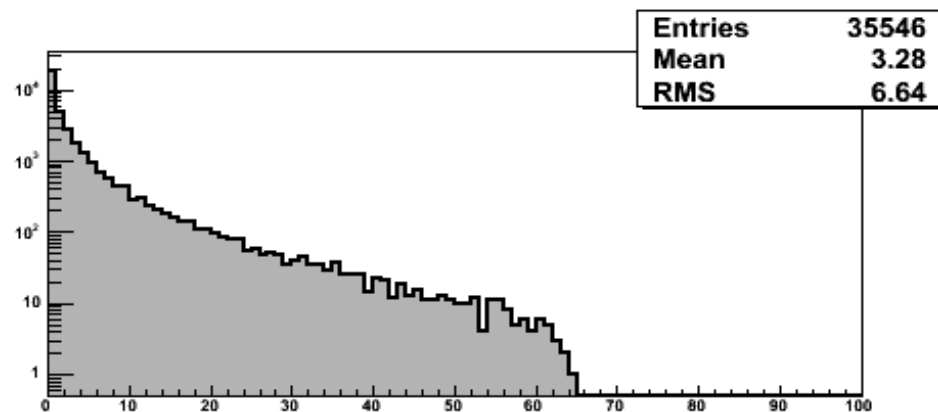
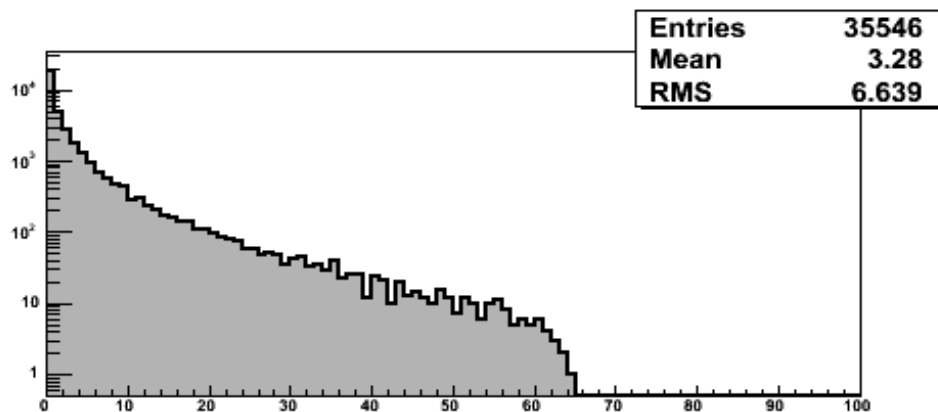
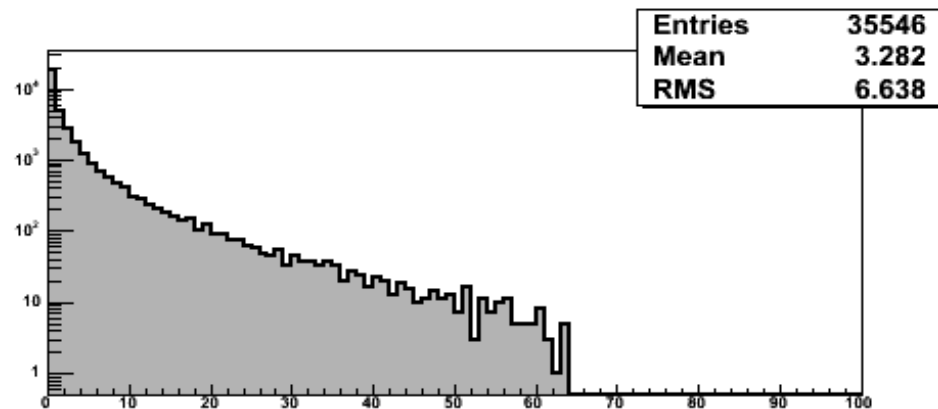
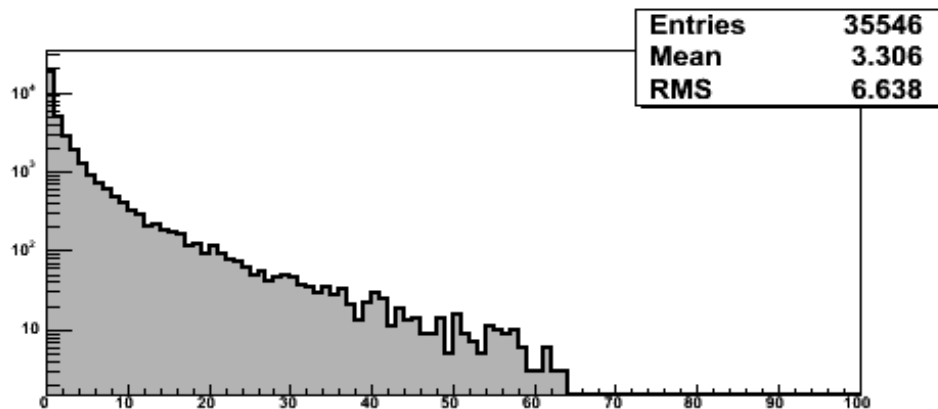
# Hit Chi2 after 1<sup>st</sup> Pattern Rec







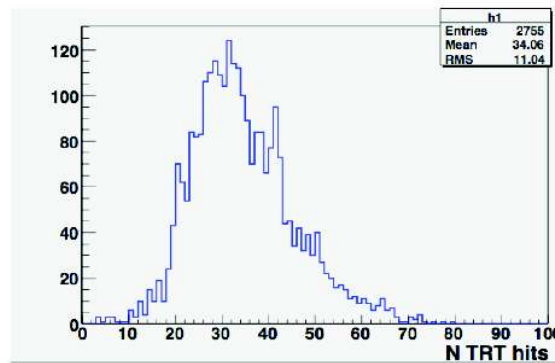
# Hit Chi2 after 2<sup>nd</sup> Pattern Rec



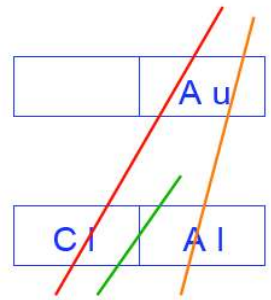


# Barrel Hits

## N Hits on Track



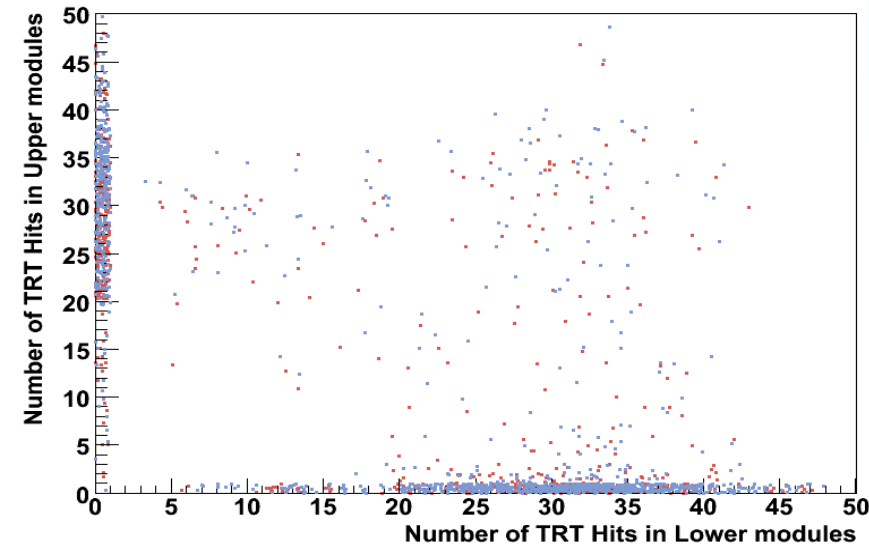
Very few tracks have hits both in upper and lower parts of the TRT.



	Au	Al	CI
Au	501	76	35
Al		1031	222
CI			889

# of TRT hits in upper modules vs # in lower modules, before and after alignment

Number of TRT hits in the upper vs lower modules, before (red) and after (blue) alignment



2008-03-11

Saša Fratina

3

Result of scintillator trigger  
+ lack of tile cal trigger



# Barrel Hits

